

WASHINGTON

# SCIENCE TRENDS

HIGHLIGHTS

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## \* PUBLIC POWER FLIGHT THREATENS ACCELERATOR PROJECT

A serious Congressional battle is threatened over two controversial and costly items in the Atomic Energy Commission budget for the current Fiscal Year. Led by utility and coal interests, the House of Representatives late last week deleted an AEC request for \$95 million to convert the new plutonium reactor at Hanford, Washington for by-product production of electricity to be "sold" to the Bonneville Power Administration. The plant was designed to make such a conversion possible.

Advocates of the Hanford program are considering an attempt to force approval by threatening to eliminate from pending legislation authority to build a \$114 million linear accelerator at Stanford University. Estimated costs on this project have increased so rapidly, fears are being expressed that the ultimate expense might reach the \$200 million level. However, some Congressional sources believe that a compromise could be forced which would restore both projects.

## \* NSF SEEKS MOHOLE CONTRACTOR

National Science Foundation will hold a briefing session July 27, 1961 on its proposed prime contract for the continuation of the Mohole Project for deep sea studies of the earth's crust. Organizations will have an additional 30 days to submit a statement of qualifications and a management plan for participation.

The Mohole Project, in its forthcoming phases, will include the conduct of deep ocean surveys; the design and construction of deep drilling equipment and the drilling of a series of holes in the deep ocean floor, one of which (it is hoped) will completely penetrate the earth's crust.

The Foundation stresses that only those organizations "capable of managing the entire project" will be considered, although the July 27 briefings would also presumably be of value to prospective subcontractors.

To qualify for consideration as a prime contractor an organization must meet the following "minimum" criteria:

- ✓ Have adequate financial resources for the performance of the contract.
- ✓ Have the necessary experience, organization, technical qualifications, skills and facilities, or the ability to obtain them. These should include the capability for designing experiments and equipment, of supervising the construction and operation of drilling ships, and of doing scientific work at sea.
- ✓ Be willing to contribute freely of its own knowledge and to permit publication of all methods and results.

(Briefing to be held at NSF Auditorium, 1951 Constitution Avenue, N. W., Washington 25, D. C. at 9 a.m. Eastern Daylight Saving Time)

\* BUREAUCRACY SPLITS THE ATOM

Editor's Note: Columbia University this week makes public for the first time some of the long-secret documents detailing the original development of the atom bomb. We found this story fascinating; and we hope that our readers -- particularly those familiar with red tape -- will share our view. The information is supplied by F. Ross Jones of the Columbia news staff.

- ♠ "Certain Properties of Uranium": "The Government's first contract for atomic energy research was made between Columbia and the National Defense Research Committee. It awarded Columbia \$40,000 and directed that University scientists, including Enrico Fermi, Leo Szilard, John Dunning, Harold Urey, Eugene Booth, Walter Zinn and George Pegram 'Conduct studies and experimental investigations in connection with certain properties of Uranium and other substances...'

The contract, known officially as NDCrc-32 was signed by Vannevar Bush, chairman of the National Defense Research Committee and by Frederic A. Goetze, treasurer of Columbia on November 8, 1940. By then war had spread over most of Europe and the United States, alarmed by the Nazi menace, and the threatening posture of Japan in the Pacific, had begun to look to its defenses. But few men besides a handful of key scientists realized then that nuclear research might have powerful military implications.

- ♠ Niels Bohr arrives: For American scientists these implications began to crystallize in January, 1939, when the Danish physicist, Niels Bohr, arrived in this country and told a few colleagues that he was about to announce that experiments had been carried out in Europe proving the uranium nucleus had been split.

On the evening of January 25, 1939, Professors Dunning and Booth, together with Dr. Francis Slack, a visiting professor of Physics from Vanderbilt University, went to the cyclotron laboratory in the basement of Columbia's Pupin Hall on Morningside Heights. They realized that, according to Einstein's famous formula,  $E=mc^2$ , the splitting of the uranium nucleus ought to release a large amount of energy.

It was about 7 P.M. when they began setting up their nuclear experimental apparatus. By 11 P.M., the three men had become the first Americans to confirm nuclear fission, and the first to measure the release of 'atomic' energy.

About five weeks later, on March 3, 1939, Professors Szilard and Zinn performed another historic experiment -- this time on the seventh floor of Pupin Hall -- which emphasized the possibility of the now-famous 'chain reaction.'

- ♠ A Million Times More Powerful?: On March 16, Dr. Pegram wrote to Admiral S. C. Hooper at the Office of the Chief of Naval Operations in Washington to tell him of the Columbia work. He began:

'...Experiments in the physics laboratories at Columbia University reveal that conditions may be found under which the chemical element uranium may be able to liberate its large excess of atomic energy, and that this might mean the possibility that uranium might be used as an explosive that would liberate a million times as much energy per pound as any known explosive.'

- ♠ Einstein Enters: Dr. Pegram's letter failed to stir any activity in Washington, so, on August 2, 1939, after being convinced by Professor Szilard and several other scientists, Albert Einstein agreed to sign a letter to President Roosevelt. The note, which urged further atomic research, opened:

'Some recent work by E. Fermi and L. Szilard which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which have arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration.'

\* BUREAUCRACY SPLITS THE ATOM (Continued)

By February 1940 the Army and Navy were sufficiently interested in nuclear experiments to award Dr. Pegrum a \$6,000 grant to aid researchers at Columbia. The pace quickened, and by November the government was ready to award its first contract for atomic research to Columbia. The experiments, under the 'full and direct charge' of Dr. Pegrum, were to be conducted in the utmost secrecy.

The high hopes of many government officials for these secret Columbia experiments were expressed in one brief sentence on November 15 by Irwin Stewart, secretary of the National Defense Research Committee. In a letter, filed early in the Columbia correspondence folder, to Douglas Gibbs, assistant Columbia treasurer, Stewart wrote:

'I trust that the research under this contract proves to be highly beneficial to national defense.'

o The Graphite Wall: Using the \$6,000 Army and Navy grant, Professor Fermi and his colleagues began building a small nuclear reactor. It was nothing more than a small pile of pure graphite blocks on the Morningside Heights campus. Fermi knew that he could not produce the desired chain reaction with such a pile, but he could collect important information about graphite and neutrons. He collected his data, and the wall grew -- up to the ceiling in fact, but not high enough to produce the reaction.

As the scientific team labored with the tons of black, dusty graphite, counted neutrons and collected other information, the correspondence file shows that officers, clerks and secretaries at Columbia and the NDRC struggled to adhere to the intricate details of the research contract.

o "Not Allowed": Many of the problems in the early days of the contract centered about interpretation. Columbia's scientists were pioneering, not only in nuclear energy technology, but in the complicated business of government sponsored research, now a major source of income to American universities.

For example, when the contract called for reimbursement to Columbia up to \$13,000 for 'special materials, facilities, or equipment,' the University authorities interpreted this clause to include twenty-one cents for registered mail and \$6.46 for telephone service used in connection with the project. They charged the two items to the NDRC.

'Not allowed,' said the government. The voucher was returned to Columbia with the suggestion that it be resubmitted without the \$6.67. The government now has invested many billions of dollars in the results of that research.

o U. S. Program Grows: In October 1941, about the same time that the government decided to construct an atomic bomb, Dr. Pegrum and Dr. Urey, Nobel-Prize-winning professor of Chemistry then at Columbia, were sent to England to discuss with British scientists the question of atomic energy. When the two Columbia scientists returned from England their reports made it clear that the U. S. would have to assume the chief responsibility of out-distancing the Axis in the perfection of atomic power. The government decided that at Columbia greatly enlarged efforts should be put on the diffusion method of separation of Uranium-235, a method proposed by Professor Dunning and his group, that was and still remains, the starting point for the vast nuclear-energy complex the American government has built. At the same time, every effort was to be made to attain the chain reaction in a uranium-graphite pile, on which progress had been made by Fermi's Columbia research team.

By November it was obvious to Fermi that he and his associates could not conclude the experiments in their limited quarters in Schermerhorn Hall. They needed more room. There was nothing available on Morningside Heights, so they began to search elsewhere in the metropolitan area.



\* BUREAUCRACY SPLITS THE ATOM (Continued)

On December 6, Vannevar Bush, who had signed NDCrc-32 thirteen months earlier, announced that the government would expand its atomic research program. He also said that he had appointed Professor Arthur H. Compton of the University of Chicago to be in charge of the basic studies of the chain reaction.

The following day, the Japanese bombed Pearl Harbor.

- Ø Move to Chicago: Soon after Compton assumed his new position, he summoned Fermi to Chicago for conferences. And shortly afterwards, Compton decided that all the work under his command should come to Chicago.

Herbert Anderson, Fermi's close associate, left for Chicago immediately. Professor Zinn stayed at Columbia for a few months. And Fermi, who was to remain a Columbia professor until September, 1945, traveled between the two campuses.

The declassified materials now on display show that in February, 1942, Columbia scientists began shipping the project's materials and equipment to the University of Chicago's 'Metallurgical Laboratory,' the innocuous title given to the project's new headquarters.

Further shipments were made on April 15, 22, 25, 28 and May 1, 1942. A variety of items was sent from Columbia. The list included everything from standard scientific items and tons of graphite to a can opener and a paper towel holder.

In their haste to consolidate the project in Chicago, many of the group carried various pieces of equipment in their pockets and luggage.

Property lists accompanying the correspondence show that among the items shipped from Columbia were 1 stop watch, 2 oscilloscopes, 13 crucibles, 1 long nose pliers, 6 Sears Roebuck benches, 6,477 lbs. of lead bricks, 1 slide rule, 1 large safe, 15,769 lbs. of 'X-oxide' (which was the uranium oxide), 36,894 lbs. of graphite, 1 paper towel holder, 2 electric soldering irons, 1 can opener, and 1,220 lbs. of steel beams.

- Ø Squash Court Science: These, then, were a few of the hundreds of items that were crated on Morningside Heights and shipped to Chicago. On arrival they were sent to the University's Stagg Field and opened in a squash court beneath the West Stands.

By October 15, 1942, a new atomic pile was under construction on the squash court, and the scientists, carpenters, machinists, and high school boys hired to lay the bricks, labored from day to day in the black dust of the graphite.

On the morning of December 2, with Professor Fermi in charge, the researchers were ready to attempt to achieve a chain reaction. The final cadmium control rod was ready to be removed from 13 feet within the pile. The Columbia professor had calculated that the removal of the rod would cause the chain reaction.

The rod was pulled out, slowly and steadily as radiation was measured. About 3:20 P.M., Fermi was sure that one more pull would start the reaction.

The rod was moved. The needles on the counter dials swerved upward. The world's first chain reaction had occurred.

\* MICROWAVE IMPEDANCE CALIBRATION SERVICE

A service for the calibration of waveguide reflectors in the microwave frequency region is now being offered by the Electronic Calibration Center, National Bureau of Standards, Boulder, Colo. A modified reflectometer system is employed.

(For details of the Microwave Impedance Calibration Service write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

## T E C H N I C A L   T R E N D S

- A new report showing a 6.3 percent gain in "miscellaneous" synthetic organic chemical output during 1960 is now available upon request to the Information Office, U. S. Tariff Commission, Washington 25, D. C. ✓✓✓ Information on a greatly expanded research program in radiological health is now available from Dr. Paul F. Hahn, Chief, Office of Extramural Grants, Division of Radiological Health, U. S. Public Health Service, Washington 25, D. C. ✓✓✓ The Office of Information, Office of Aerospace Research, U. S. Air Force, Washington 25, D. C. has available Release 7-61-1 outlining \$4.1 million in new or renewed contracts and grants to some 70 universities, research institutions and industrial laboratories. ✓✓✓ National Aeronautics and Space Administration has selected Douglas Aircraft Corp. for a \$450,000 contract for development of orbital placement techniques and engineering design applications for the Project Rebound passive communications satellite.
  
- The U. S. Bureau of Mines, Division of Minerals, Washington 25, D. C. has available Mineral Market Report MMS-3235 outlining the state of the U. S. chromium industry in 1960. ✓✓✓ Lockheed Aircraft Corp. Georgia Division has won a large Army Transportation Corps contract for development of its so-called "Humming Bird" vertical takeoff research vehicle. The same agency has also contracted with Ryan Aeronautical Co. for development of a "Flex Wing" air logistics transport to be towed by a helicopter. ✓✓✓ The Navy Bureau of Weapons is interested in development of analytical techniques for determination of minute quantities of impurities in metals. ✓✓✓ U. S. Industries Inc. will conduct an Army Ordnance feasibility study of a demonstrated breadboard model of a tethered, low-altitude rotor platform system. The system would be used with tanks and combat vehicles for detecting and identifying vehicle targets at ranges up to 2,000 meters.
  
- The Navy has awarded a sizable contract to Development Engineering Corp., Washington 25, D. C. to make its communications moon relay system compatible with a communications satellite relay. The system will ultimately be part of a ship to shore and ship to ship program. ✓✓✓ Western Union Inc. will demonstrate for the Navy's Bureau of Ships a new Trans-Ocean Cable Junction concept. ✓✓✓ The Commodity Standards Division, U. S. Department of Commerce, Washington 25, D. C. has available single free copies of a new listing of commercial standards adopted by industry to establish quality requirements for products, including methods of testing, rating or grading. Ask for Catalog No. 978. ✓✓✓ Information on a forthcoming meeting in Boston, Mass. on highway implications of electronics and computers is available from W. D. Dillon, Division of Development, Office of Operations, Bureau of Public Roads, Washington 25, D. C.
  
- The Atomic Energy Commission, Office of Information, Washington 25, D. C. has made available Announcement 7761, a transcript of a June 29, 1961 press conference on the atomic isotope generator used in a transit satellite. ✓✓✓ The AEC is making available \$80,000 in nuclear equipment to foreign nations including a mass spectrometer ion source and an electron paramagnetic resonance spectrometer for Argentina; equipment for research in the use of isotopes in Agriculture for Brazil and none mobile and two stationary monitoring stations for use in the area surrounding Israel's swimming-pool type research reactor. ✓✓✓ The National Weather Records Center, Asheville, North Carolina has for sale 35mm positive transparencies and duplication negatives of certain TIROS I weather observation satellite pictures. Single copies of a preliminary brochure documenting picture sequences may also be available at no charge.
  
- Roger Revelle, director of the Scripps Institution of Oceanography, has been appointed science advisor to the Secretary of the Interior. ✓✓✓ The first test firing of the complete, self-cooled F-1 rocket engine has taken place at Edwards Air Force Base, Calif. The liquid oxygen-kerosene F-1 is being developed for the large Nova launch vehicle. ✓✓✓ Northrop Corp. has received an Air Force contract to study sealants and self-sealants to protect spacecraft from the space environment.

## P U B L I C A T I O N   C H E C K L I S T

- DEFENSE SPACE INTERESTS, testimony, statements and exhibits presented by representatives of the military services in support of their past, present or planned space programs and philosophy. 219 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for Hearing-No. 8, Defense Space Interests)
- DEFENSE HIGHWAY NEEDS, a critical report on the Government bungling which created a network of defense highways with bridges too low to permit missiles and other large military equipment to pass. (Write Chairman, Committee on Public Works, U. S. House of Representatives, Washington 25, D. C. for House Report No. 363 -- Defense Highway Needs)
- BI-METAL REDUCED HAFNIUM, a technical report on a pilot-plant method of obtaining ductile hafnium for possible use in nuclear power plants. 21 Pages. Single Copies Free. (Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5734)
- SEMICONDUCTOR NUCLEAR PARTICLE DETECTORS, the proceedings of an informal conference at Asheville, N. C., September, 1960 on a diverse group of problems and properties ranging from surface physics to the conceptual design of ultra-low-noise amplifiers. Emphasizes the need for more development work on improving the reliability of existing devices to the point where they can become routine analytical tools, and further research on new devices with greater stopping power, increased sensitive volume and better signal-to-noise characteristics. 277 Pages. \$2.50. (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C. for Publication No. 871)
- SOVIET PETROLEUM PLANS, a circular describing Soviet goals and reported attainments under its 1959-65 Seven Year Plan, and implications. Single Copies Free. (Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Information Circular No. 8023)
- SCIENTIFIC AND TECHNICAL SOCIETIES, a new edition of a standard reference listing 1,597 U. S. and 239 Canadian societies, with much detailed information on organization, membership, publications and library resources, etc. 512 Pages. \$9. (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C. for Publication 900)
- IBM IN FRANCE, an independent study of how a French-managed subsidiary of International Business Machines has made a "massive" contribution to the progress of France, particularly in technology. \$1. (Write Publications Office, National Planning Association, 1606 New Hampshire Avenue, N. W., Washington 9, D. C. for "IBM in France")
- TUNGSTEN, a review of some major developments in the technology of tungsten from January through April, 1961. 4 Pages. Single Copies Free to Government agencies, their contractors, subcontractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio for DMIC Memorandum No. 108)
- DELAY TECHNIQUES, a fine state-of-the-art survey of delay techniques in electronic systems, particularly those which result in a time delay due to the reduction in velocity of propagation or medium. Covers present research and future possibilities. (Report RADC-TR-60-146 (( PB 171 420 )) available through military channels or at \$1.25 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

